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A Bibliography of Gynogenesis and Androgenesis in Fish (1913-1989)

I. I. Solar, E. M. Donaldson, and D. Douville

Biological Sciences Branch
Department of Fisheries and Oceans
West Vancouver Laboratory
4160 Marine Drive
West Vancouver, British Columbia V7V 1N6

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I. I. Solar, E. M. Donaldson, and D. Douville

Biological Sciences Branch
Department of Fisheries and Oceans
West Vancouver Laboratory
4160 Marine Drive
West Vancouver, British Columbia V7V 1N6

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ABSTRACT

Solar, I. I., E. M. Donaldson, and D. Douville. 1991. A bibliography of gynogenesis and androgenesis in fish (1913-1989). Can. Tech. Rep. Fish. Aquat. Sci. 1788: 41 p.

This bibliography presents a listing of 347 publications on the subject of gynogenesis and androgenesis in fish species. Included are references dealing both with induced and naturally occurring gynogenetic fish, and with induced androgenesis in fish (15 entries), published between the years 1913 to 1989. Each reference is indexed by author(s) and species. A list of the 15 papers dealing with androgenesis, and a list of 44 review works on the general subjects of chromosome set manipulation and sex control, in which gynogenesis or androgenesis are discussed, are also included.

RÉSUMÉ

Solar, I. I., E. M. Donaldson, and D. Douville. 1991. A bibliography of gynogenesis and androgenesis in fish (1913-1989). Can. Tech. Rep. Fish. Aquat. Sci. 1788: 41 p.

Cette bibliographie présente 347 publications sur la gynogenèse et l'androgenèse chez les poissons. Elle cite des documents traitant de la gynogenèse naturelle ou induite de même que de l'androgenèse induite chez les poissons (15 entrées) publiés entre 1913 et 1989. Un index des auteurs et des espèces couvre l'ensemble des références. Une liste des 15 articles traitant de l'androgenèse et une liste de 44 textes généraux sur la manipulation des génômes et la détermination du sexe, où il est question de gynogenèse et d'androgenèse, sont fournies.

INTRODUCTION

Gynogenesis, sometimes referred to as "pseudogamy", "pseudofertilization" or "parthenogenesis", is a form of unisexual reproduction whereby females produce offspring with all their inheritance from the female parent. Although present in nature in several lower phyla (Kiester et al., 1981), only certain Amphibia, Reptilia and Pisces are known among the Vertebrata to reproduce by a gynogenetic mechanism in which the sperm of a related species is used to trigger embryonic development without contribution from the paternal genome. Among the fishes, natural gynogenetic populations are known to occur only in freshwater species of the families Poecilidae (e.g. *Poecilia formosa*, the Amazon molly, Hubbs and Hubbs, 1932) and Cyprinidae (*Carassius auratus gibelio*, the crucian carp, Lieder, 1959). Two phenomena are frequently associated with natural gynogenesis : a) triploidy, resulting from the fertilization of unreduced eggs with haploid sperm occurs in certain all-female forms of *Poecilia* and *Carassius*, and b) hybridogenesis, in which although male and female gametic fusion takes place, the phenotype expressed is matroclinous.

Artificial gynogenesis in a fish species, the brown trout (*Salmo trutta*), was first reported by Opperman (1913). Since then, gynogenesis has been induced in several fish species, particularly cyprinids and salmonids. The initial intended application of induced gynogenesis was as a method of sex control for the aquacultural production of monosex populations in female homogametic species (Stanley et al., 1975; Nagy et al., 1978; Refstie et al., 1982). The method has also been applied to the generation of inbred lines for genetic studies. The degree of homozygozity achieved depends on whether the restoration of diploidy is induced by polar body retention (Cherfas and Truveller, 1978; Nagy and Csanyi, 1984), or by the suppression of the first mitotic division. Although mitotic gynogenesis is more difficult to achieve, the offspring produced are highly homozygous, thus allowing the production of inbred clones in two generations (Streisinger et al., 1981; Nagy et al., 1983; Chourrout, 1984; Naruse et al., 1985b).

A more recent application of gynogenesis is as an in-vivo chromosome-mediated gene-transfer technique through retention, after sperm irradiation, of residual genetic material from the male parent (Thorgaard et al., 1985; Disney et al., 1987, 1988).

Androgenesis, is a form of paternal inheritance achieved by the use of normal sperm to fertilize gamma irradiated eggs. Induced androgenesis has not been studied as much as gynogenesis. The first report on induced androgenesis in fish was published by Romashov and Belyaeva (1964) working with the loach (*Misgurnus fossilis*). Recent studies have emphasized androgenesis in salmonids (Arai et al 1980; Onozato, 1982; Parsons and Thorgaard, 1984).

Interest in induced androgenesis derives mainly from its posibilities for sex control, i.e., production of monosex male stocks in male

homogametic species or through the induction of "super-males" (YY males in male heterogametic species, such as salmonids and cyprinids). Studies in medaka (Yamamoto, 1964), in goldfish (Yamamoto, 1975) and in coho salmon (Hunter el al., 1982) have demonstrated the viability of YY males and suggested the potential for producing them by androgenesis.

Other interesting applications of induced androgenesis are the rapid generation of inbred lines, the potential for cloning, the recovery of genotypes from cryopreserved sperm (Parsons and Thorgaard, 1985), and investigation of the effects of paternal nuclear genotypes and, maternally inherited, mitochondrial genotypes on development and performance (Thorgaard et al 1986).

The references hereby presented were compiled from a variety of sources, mainly The Aquatic Sciences and Fisheries Abstracts (ASFA, CD Cambridge 1982 - 1989), BIOSIS Database and CAN\SDI, Science Citation Index. Many entries were also obtained from reference lists of major review articles on the subjects covered, and from the author's personal collections of reprints. The references were considered appropiate for inclusion in this bibliography if the terms " gynogenesis', "androgenesis" or their derivations were part of the title or appeared in the abstract, or if there was a heading or special paragraph dealing with one these subjects in review articles on sex determination, controlled reproduction, or chromosome set manipulation.

The references are listed alphabetically by author and numbered consecutively. To facilitate location of certain references we include an author index, a list of review works in which gynogenesis and androgenesis are discussed, a summary list of those papers on the subject of androgenesis, and a species index.

This bibliography should be complete and up to date (1989), however we apologize for any ommissions and ask that they be brought to our attention.

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